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Wagner

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(54) TRUSS RODS

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

(63) Continuation of application No. 13/787,551, filed on Mar. 6, 2013, now Pat. No. 8,853,512.

(51) **Int. Cl.**
G10D 3/06 (2006.01)

(52) **U.S. Cl.**
CPC ***G10D 3/06*** (2013.01)

(58) **Field of Classification Search**
CPC G10D 3/06; G10D 1/00; G10D 3/143
USPC .... 84/290, 293, 267, 312 R
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,233,122	A	8/1993	Kim	
5,249,498	A *	10/1993	Wilfer et al.	84/293
7,507,887	B1	3/2009	Blanchard	
8,853,512	B2 *	10/2014	Wagner	84/312 R

* cited by examiner

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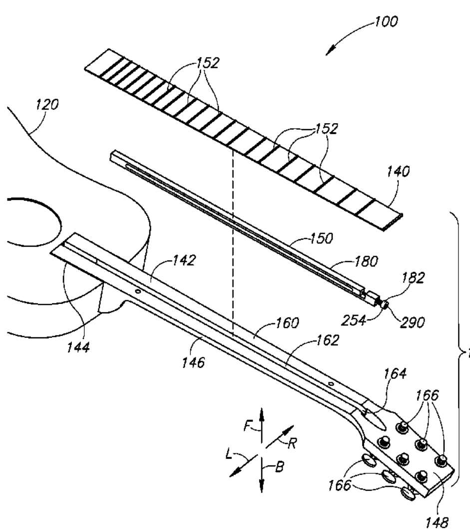
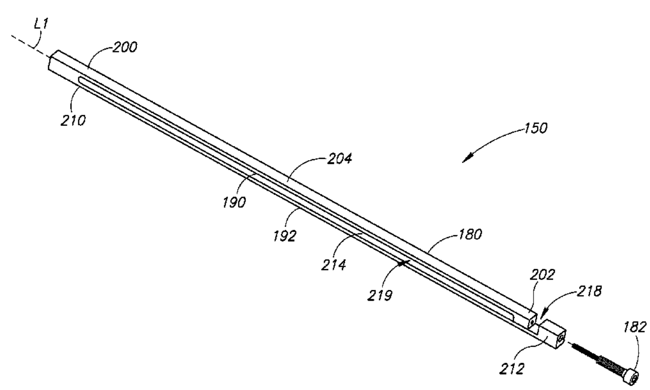
(57) **ABSTRACT**

A truss rod for use with a neck body of a musical instrument. The truss rod includes a first rod connected to a second rod. An adjustment member is connected to the first rod and configured to exert a longitudinally directed force on the first rod that causes the first rod to move longitudinally with respect to the second rod. This movement exerts a laterally directed force on the second rod that causes the second rod to exert a laterally directed force on the neck body to thereby change the curvature of the neck body. The adjustment member may threadedly engage the first rod and exert the longitudinally directed force on the first rod by threading into or out of the first rod. The adjustment member may also threadedly engage the second rod. Different thread pitches may be used to threadedly engage the adjustment member with the first and second rods.

20 Claims, 10 Drawing Sheets





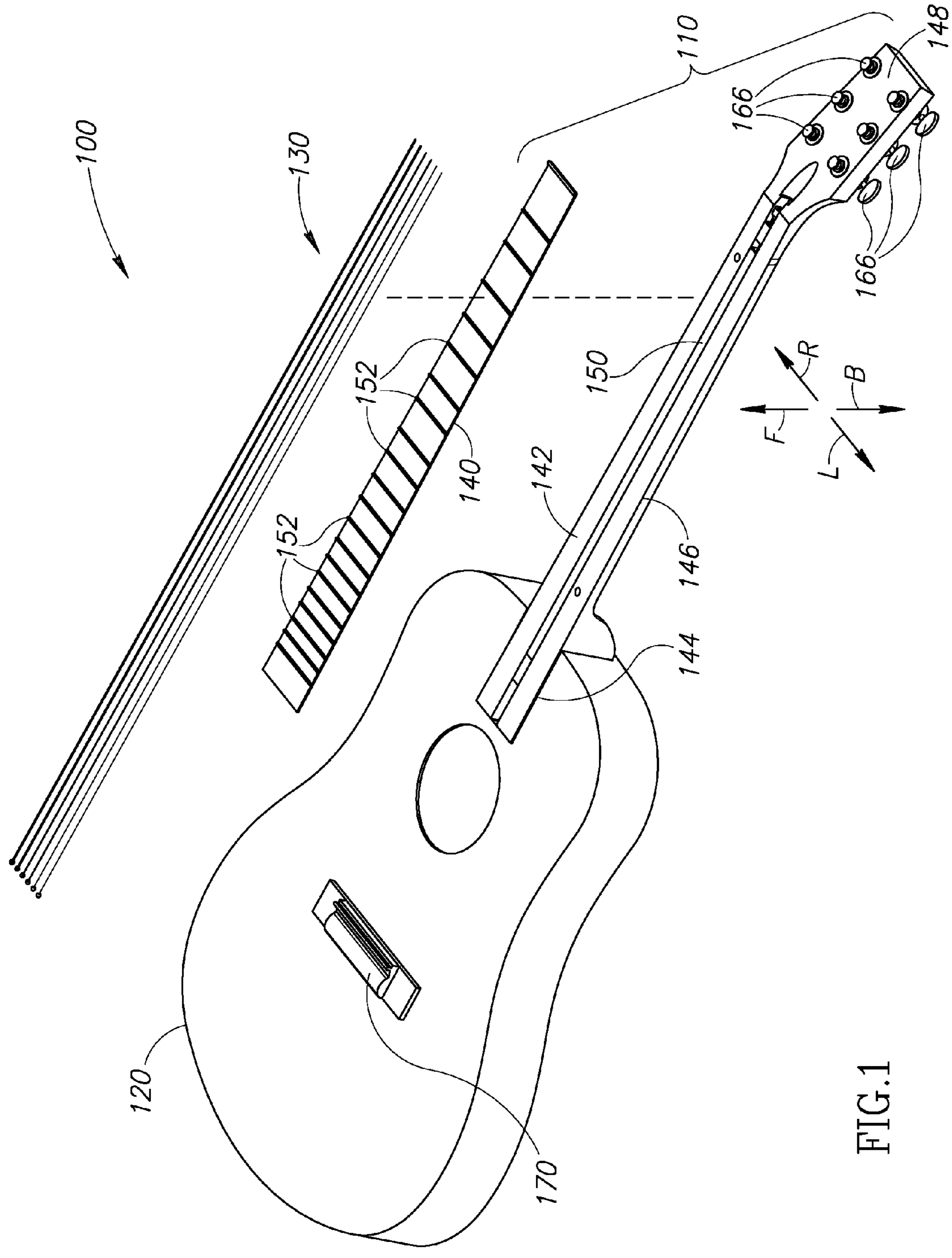


FIG.1

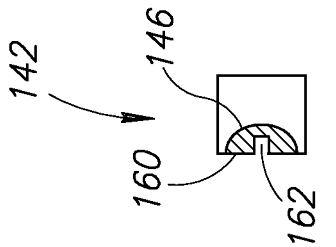


FIG.5

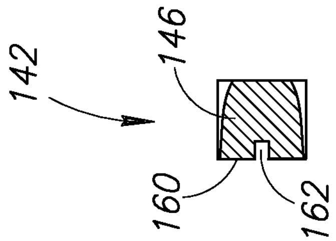


FIG.4

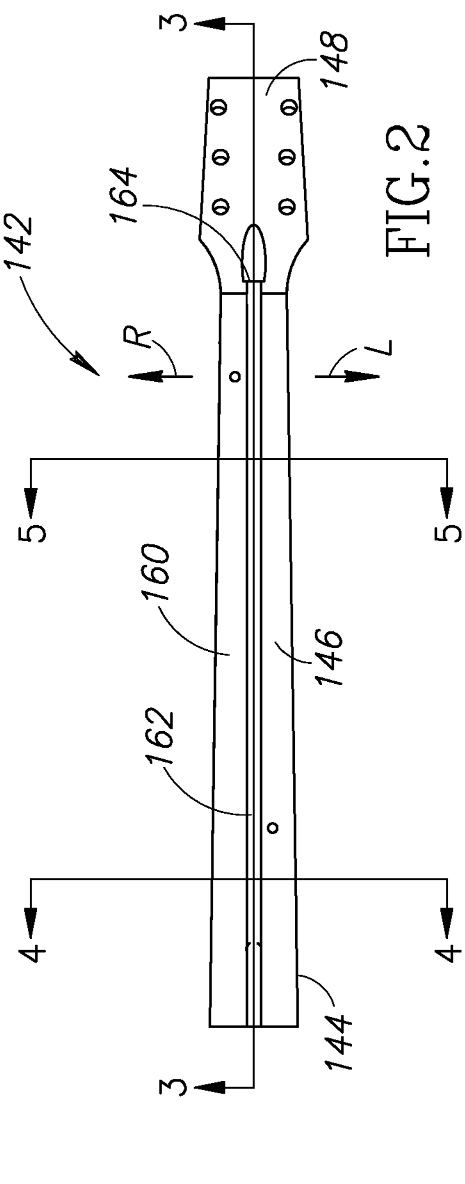


FIG.2

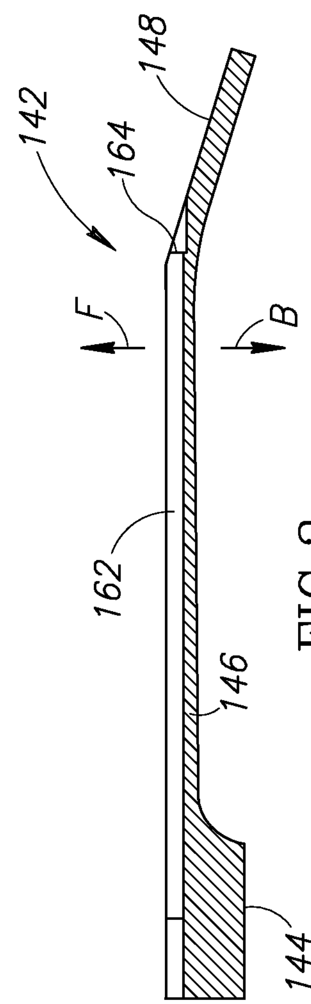
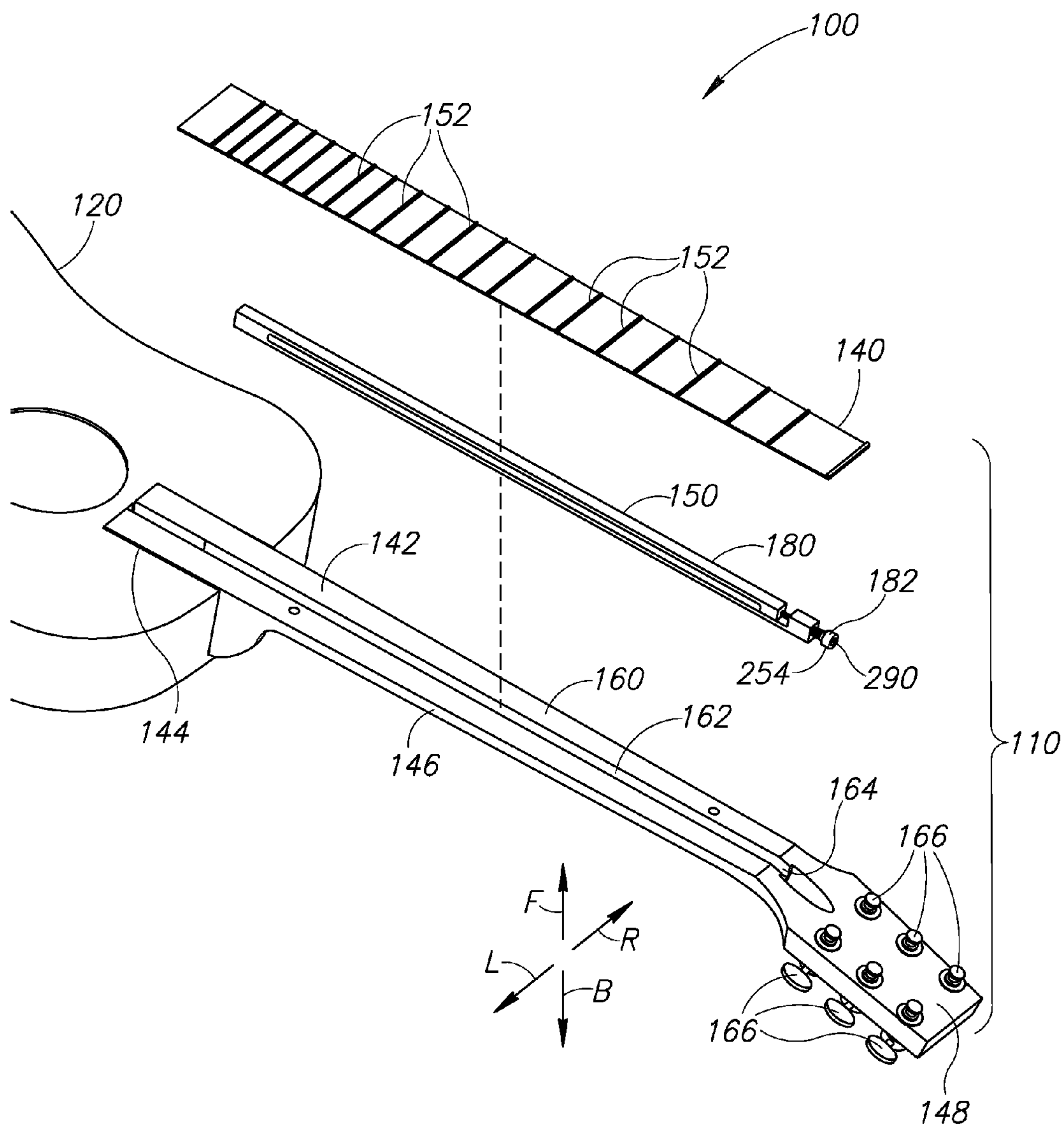


FIG.3



100
152
120
152
140
150
180
182
142
254
290
160
144
162
146
110
164
166
F
R
L
B
166
148

FIG.6

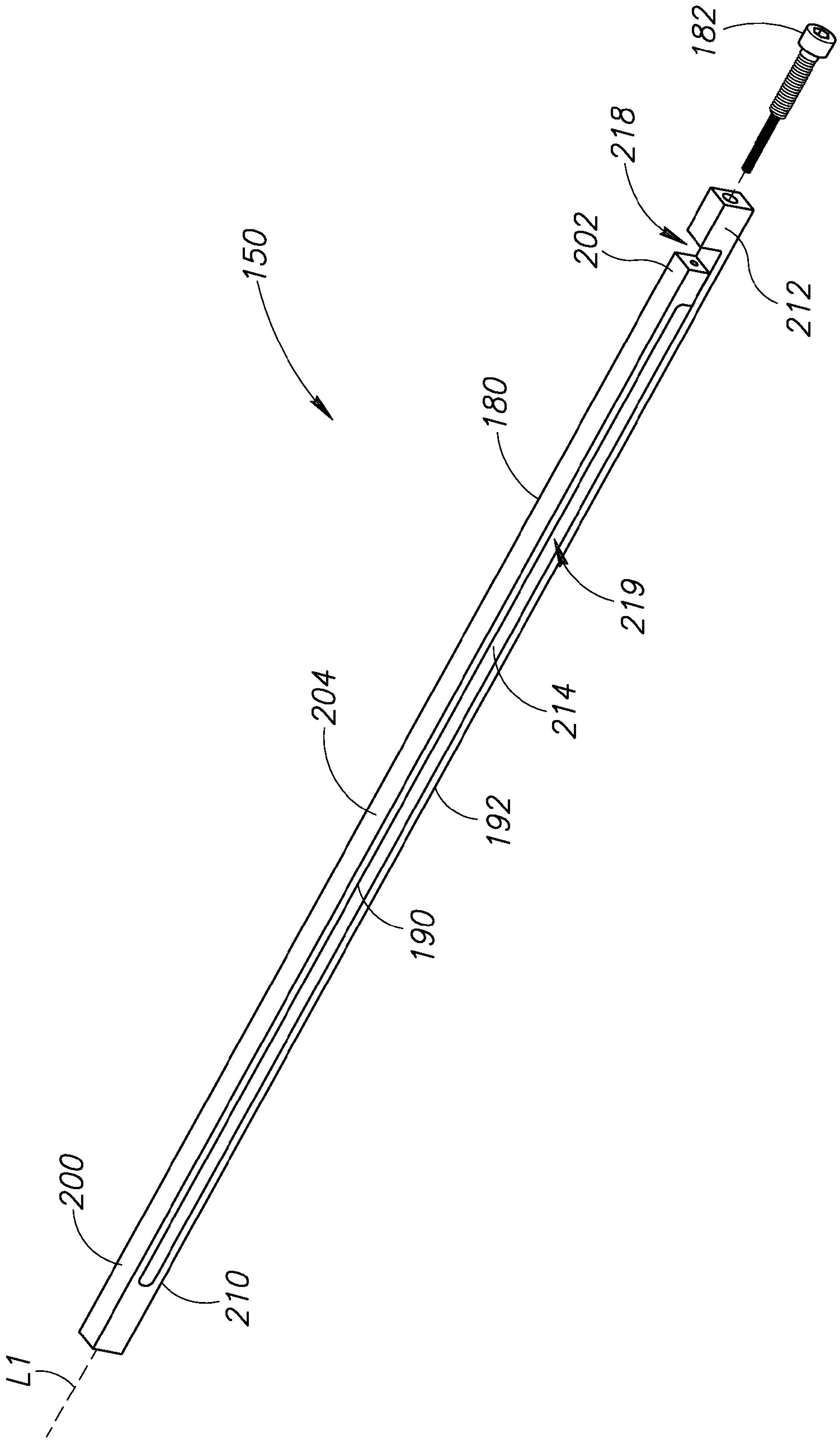


FIG.7

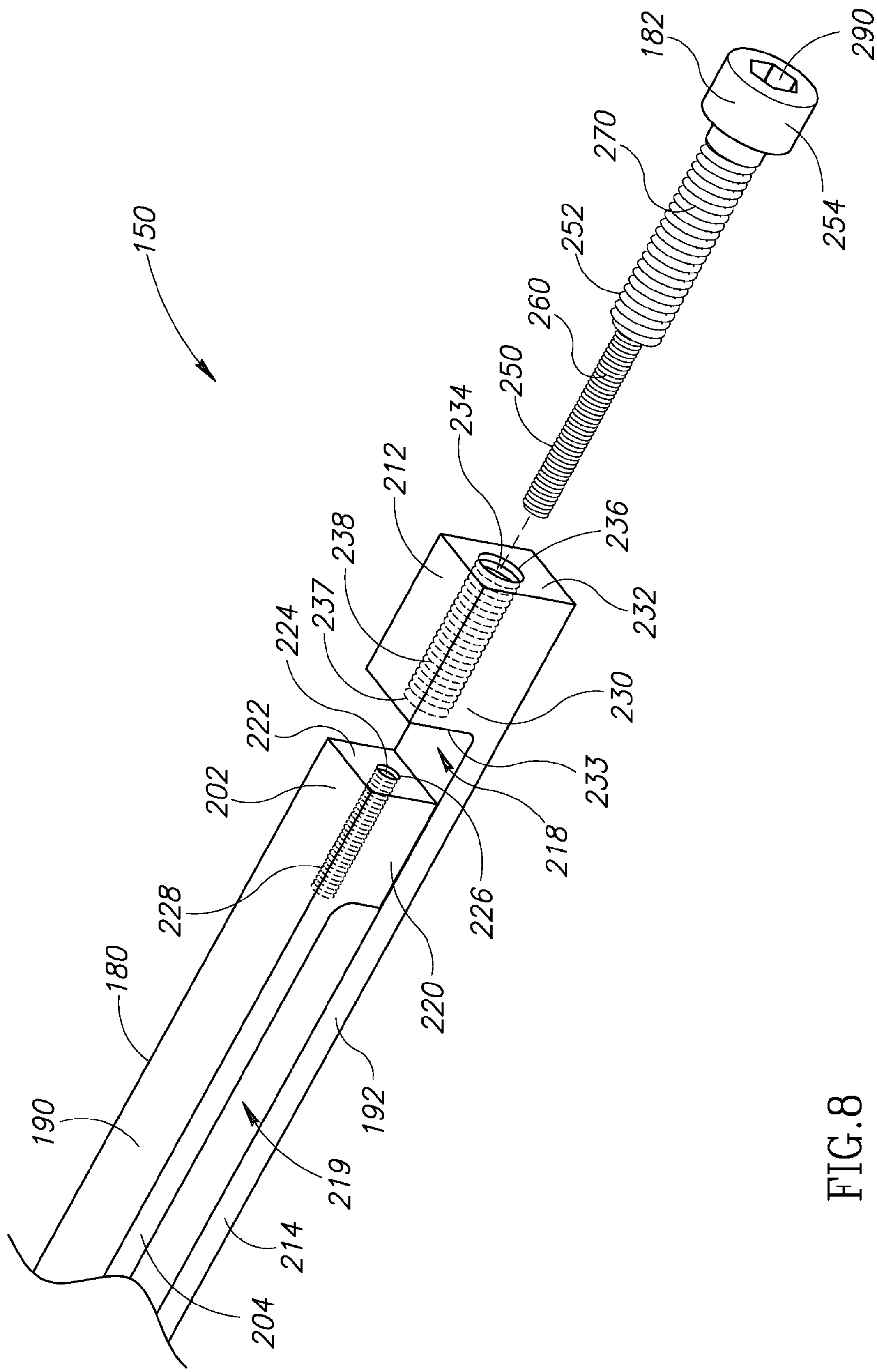

150
182
290
270
254
252
260
250
234
212
236
238
232
237
224
230
222
233
202
218
228
226
180
220
192
190
219
214
204

FIG.8

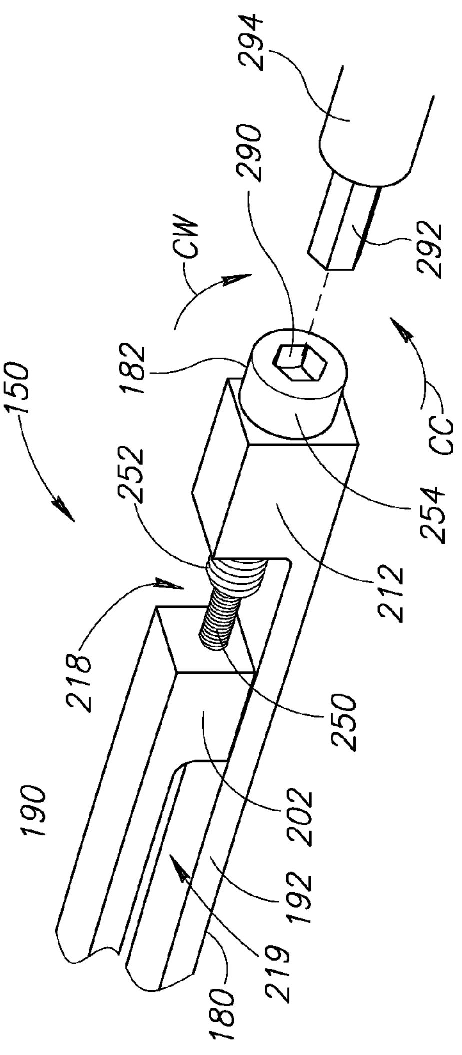

150
182
CW
290
294
292
CC
254
212
252
218
250
202
190
192
219
180

FIG.9

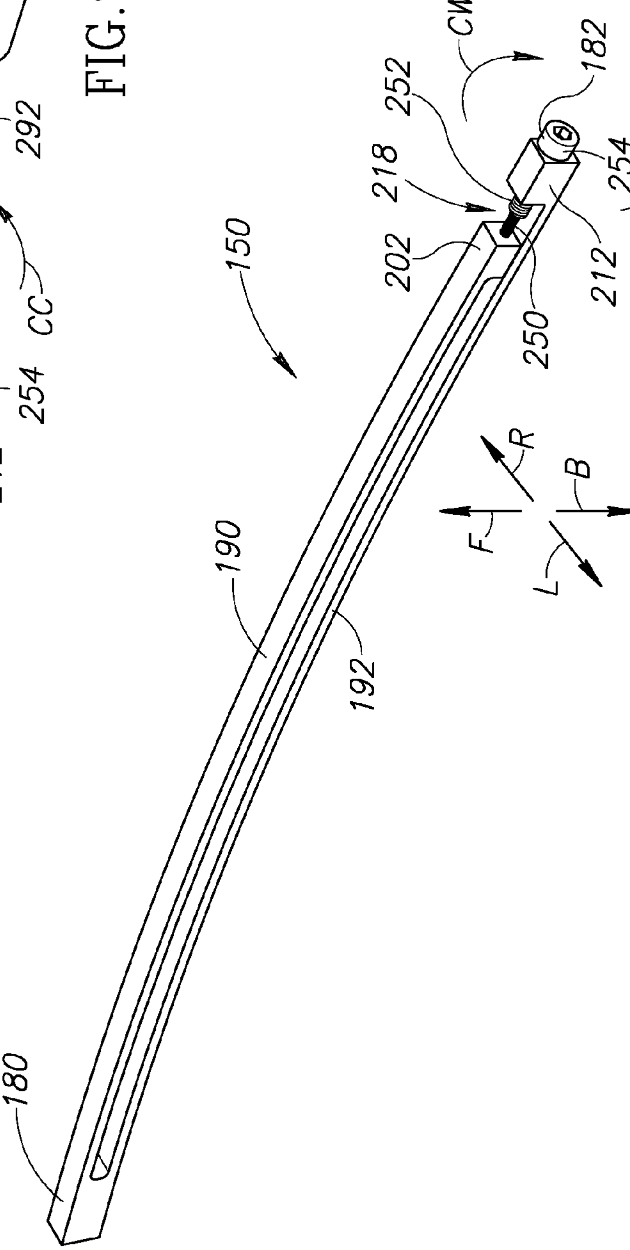
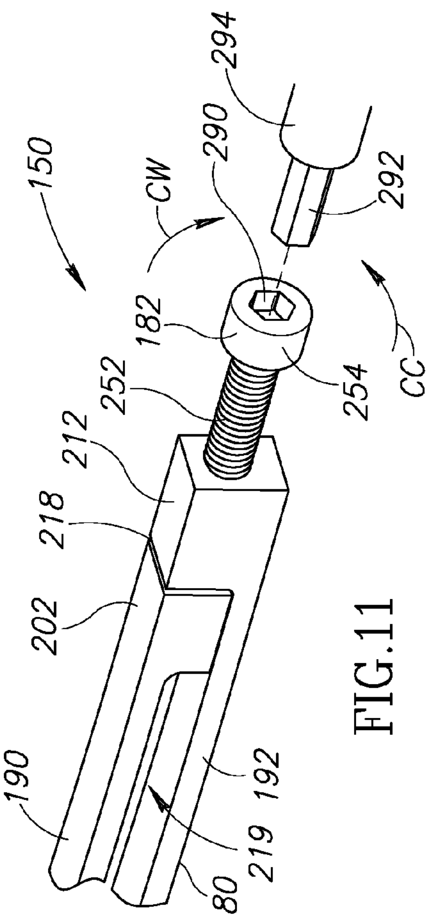
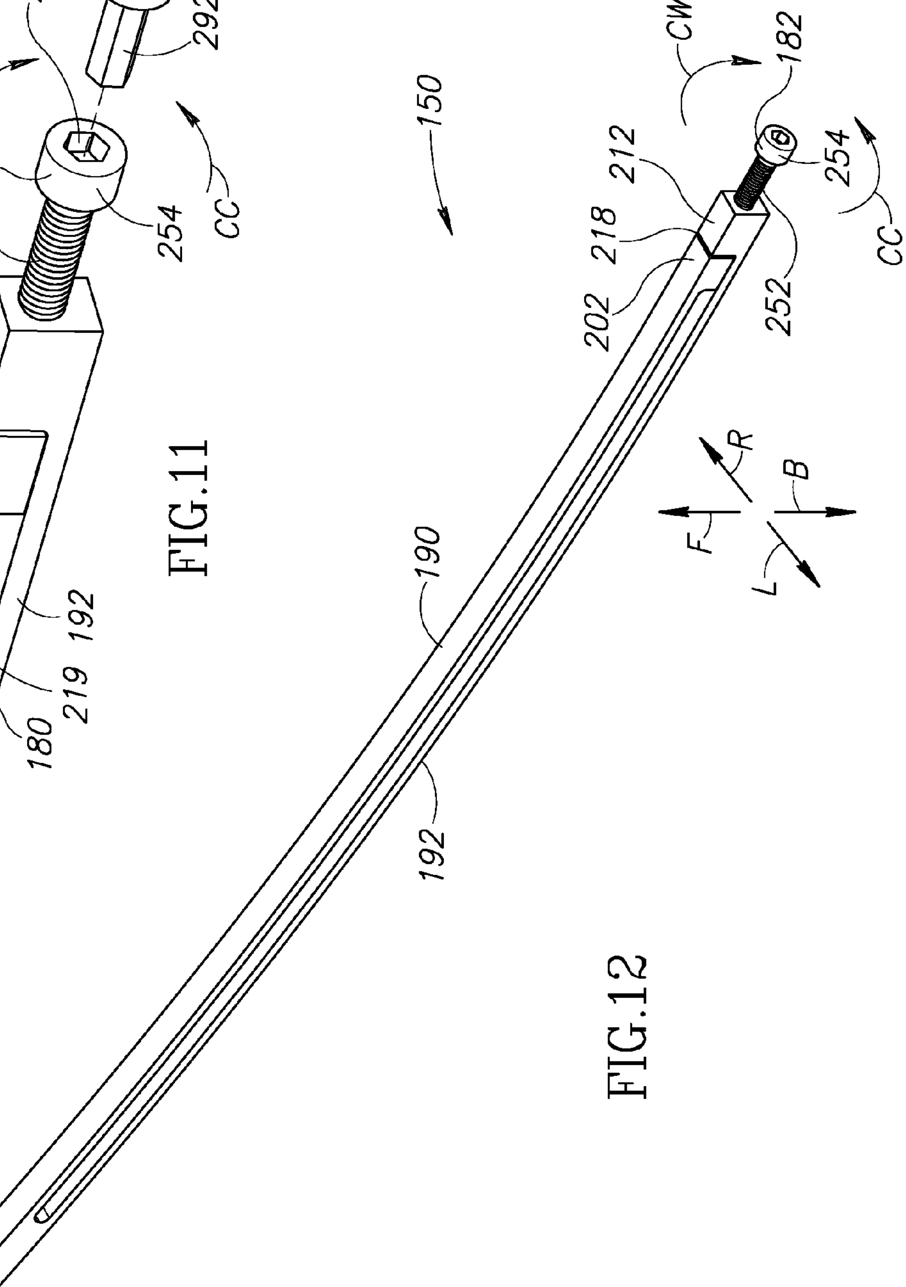

150
202
218
252
CW
182
254
212
250
CC
R
B
F
L
190
192
180

FIG.10



150
294
290
292
CW
CC
182
254
252
212
218
202
190
192
219
180

FIG.11



150
CW
CC
182
254
252
212
218
202
190
192
180
R
B
F
L

FIG.12

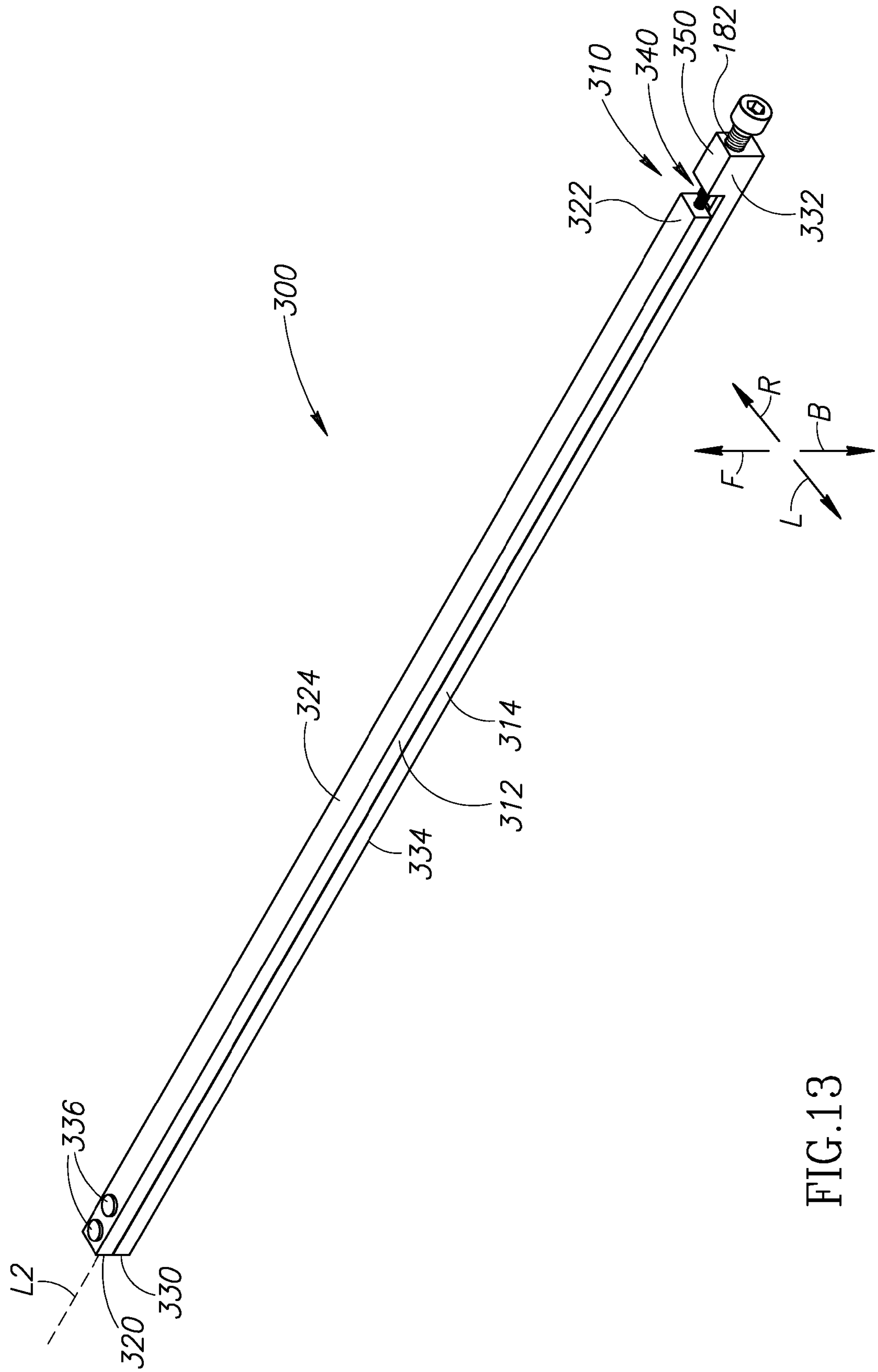


FIG.13

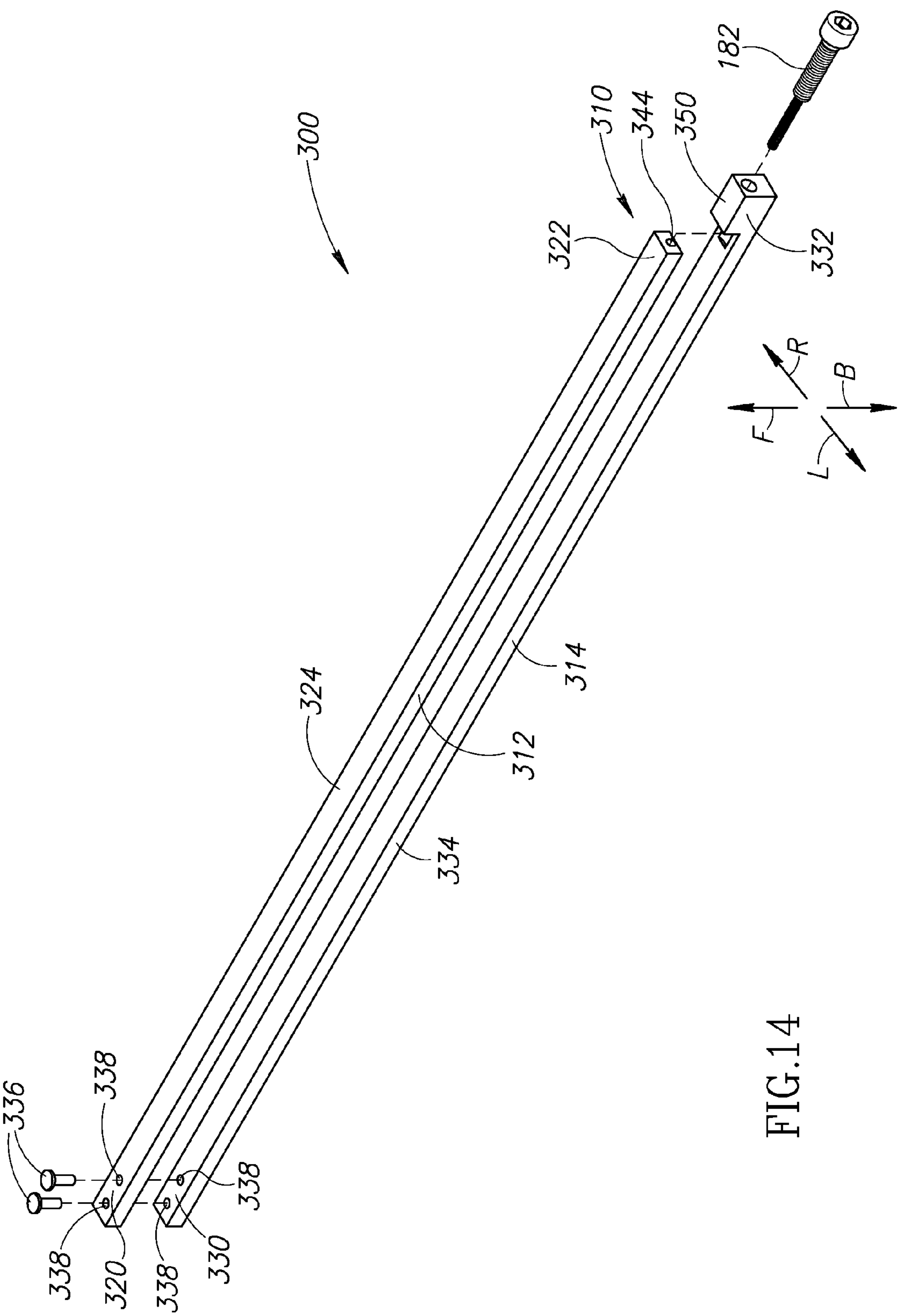
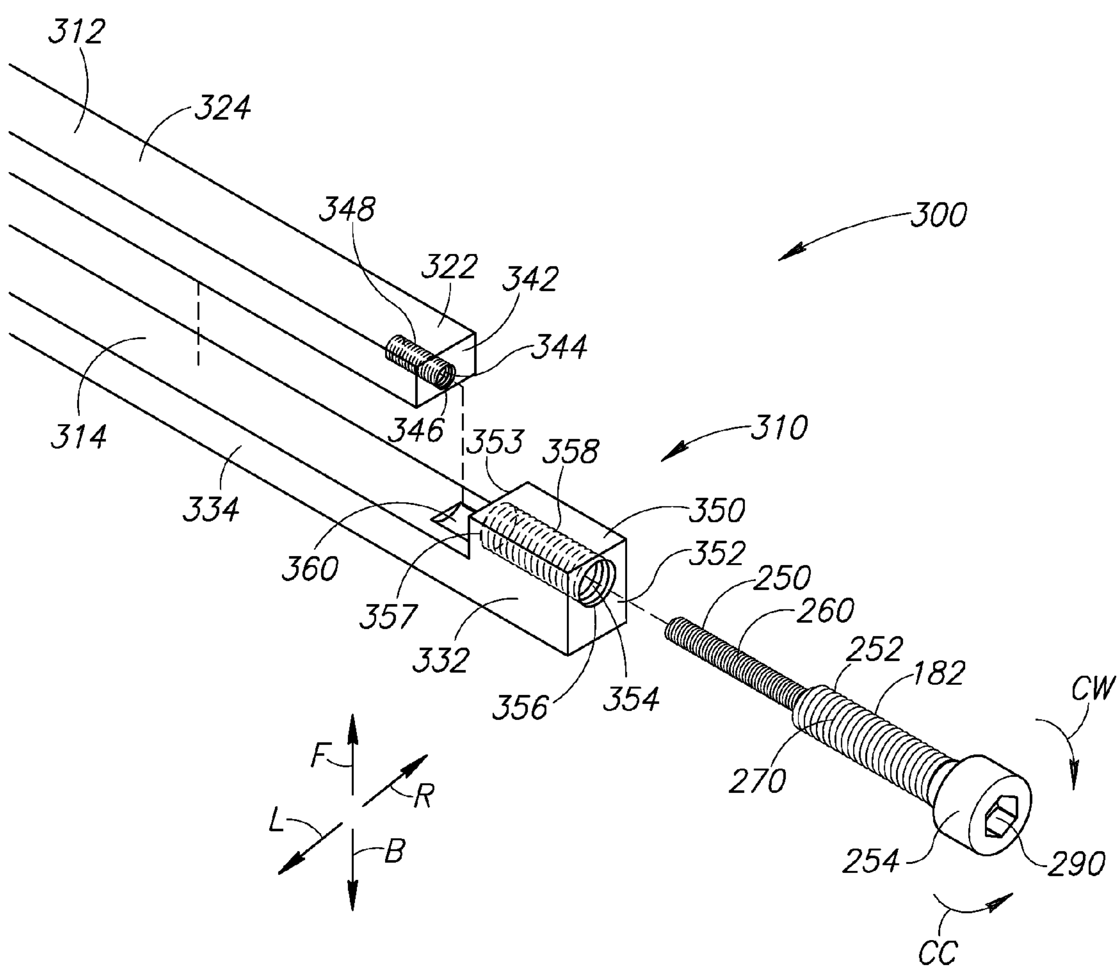

300
310
344
350
182
322
332
R
B
F
L
324
314
312
334
336
338
338
338
338
320
330

FIG.14


312
324
348
322
342
344
346
314
334
300
310
353
358
350
352
360
357
332
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354
250
260
252
182
270
254
290
CW
CC
F
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FIG.15

TRUSS RODS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed generally to truss rods that are installable in necks of stringed musical instruments, such as guitars.

2. Description of the Related Art

Many stringed instruments (such as guitars, bases, cellos, violins, violas, and the like) have a body portion connected to a neck. The body portion and neck are typically constructed from wood. The neck may include a fingerboard on which a plurality of spaced apart frets may be distributed lengthwise. A plurality of stings are attached at one end to a distal portion (sometimes referred to as a "headstock" or "peg head") of the neck, and at the other end to the body portion of the instrument. Tension is imparted into the strings (often by tuning pegs). Unfortunately, this tension may bend the neck such that the neck curves away from the strings (referred to herein as a "backward" direction). In other words, when viewed from the front, the neck may curve concavely.

A truss rod may be installed in the neck under the fingerboard to help counteract the tension on the neck imparted by strings (or other external forces) and prevent the neck from bending. Thus, the truss rod may help maintain a desired amount of curvature (or relief) in the neck.

As a stringed instrument (e.g., a guitar) ages or is played, the wood shifts, warps, expands, contracts, and/or flexes. This movement may cause changes in the curvature of the neck. In some cases, the curvature in the neck may be adjusted to some extent by adjusting the truss rod. However, the adjustment options provided by many prior art truss rods are limited and may not be sufficient to adjust the neck into a desired shape.

For example, many prior art truss rods are configured to adjust the curvature of the neck along only a single direction (e.g., in a direction toward the strings, referred to herein as a "forward" direction). Such truss rods are commonly referred to as "single action" truss rods. Single action truss rods are effective only when the neck is bent in a direction opposite the single direction in which the truss rod is configured to adjust the curvature of the neck. Unfortunately, the neck may be bent in any direction, including toward the strings (the "forward" direction), away from the strings (the "backward" direction), sideways in a first direction (referred to herein as a "right" direction), and/or sideways in a second direction (referred to herein as a "left" direction) that is opposite the right direction. The terms "forward," "backward," "right," and "left" have been assigned arbitrarily for the purposes of describing the bending of the neck of the instrument. As is apparent to those of ordinary skill in the art, the neck may be bent in a single direction, more than one direction, and/or twisted.

A "double action" truss rod is configured to bend the neck in two directions (e.g., the forward and backward directions). Although some double action truss rods are currently available, they bend only in the middle and only in an arc-like shape. Thus, they cannot be adjusted at a specific fret along the neck of the instrument. In addition, these prior art double action truss rods are not configured to hold the neck straight with respect to the right and/or left directions. For example, many conventional truss rods have a round cross-sectional shape that allows them to rotate inside the neck of an instrument. Such "double action" truss rods allow the neck to twist and/or bend in the right and/or left directions, which may permanently ruin the instrument. This type of failure may occur during the manufacturing phase or during the life of the instrument. Further, prior art double action truss rods are both

bulky and heavy, which adds undesirable weight to musical instruments. Increased weight negatively affects the playability of an instrument.

Therefore, a need exists for new double action truss rod designs. Lighter weight, less bulky truss rods would be particularly desirable. Truss rods configured to hold the neck straight in the right and left directions are also desirable. The present application provides these and other advantages as will be apparent from the following detailed description and accompanying figures.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG. **1** is a partially exploded perspective view of a fretted and stringed instrument including a neck assembly, a body portion, and strings.

FIG. **2** is front view of a neck body of the neck assembly of FIG. **1**.

FIG. **3** is cross-sectional view of the neck body taken through line **3-3** of FIG. **2**.

FIG. **4** is cross-sectional view of the neck body taken through line **4-4** of FIG. **2**.

FIG. **5** is cross-sectional view of the neck body taken through line **5-5** of FIG. **2**.

FIG. **6** is an enlarged partially exploded perspective view the instrument of FIG. **1** in which the strings have been omitted.

FIG. **7** is an exploded perspective view of a truss rod of the neck assembly illustrated in FIGS. **1** and **6**.

FIG. **8** is an enlargement of a portion of FIG. **3**.

FIG. **9** is a perspective view of an adjustment member received fully in a body portion of the truss rod.

FIG. **10** is a perspective view of the truss rod bent forwardly by a maximum amount.

FIG. **11** is a perspective view of the truss rod in which a second end portion of a first rod portion abuts (or otherwise cannot to travel any closer to) a second end portion of a second rod portion.

FIG. **12** is a perspective view of the truss rod bent backwardly by a maximum amount.

FIG. **13** is a perspective view of a second embodiment of a truss rod.

FIG. **14** is an exploded perspective view of the truss rod of FIG. **13**.

FIG. **15** is an enlargement of portion of FIG. **14**.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a partially exploded perspective view of a stringed musical instrument **100**. While illustrated as a guitar, the instrument **100** may be implemented using any stringed instrument, such as a base, cello, violin, viola, and the like. The instrument **100** includes a neck assembly **110**, a body portion **120**, and one or more strings **130**.

The instrument **100** illustrated is fretted. Thus, the neck assembly **110** includes a fingerboard **140**. The fingerboard **140** may include a plurality of longitudinally spaced apart frets **152**. However, this is not a requirement.

The neck assembly **110** illustrated also includes a neck body **142**, and a truss rod **150**. The neck body **142** has an attachment portion **144**, an intermediate portion **146**, and a peg head **148**. The attachment portion **144** of the neck body **142** is configured for attachment to the body portion **120** of the instrument **100** in a conventional manner. The intermediate portion **146** extends between the attachment portion **144** and the peg head **148**. Turning to FIG. **2**, the intermediate portion **146** has a forward facing portion **160**. A groove **162** is formed in the forward facing portion **160** of the intermediate portion **146**. The groove **162** may extend at least partially onto the attachment portion **144** and/or the peg head **148**. The groove **162** is substantially straight along the length of the neck body **142**. As may be viewed in FIG. **3**, the groove **162** has a substantially uniform depth along the attachment and intermediate portions **144** and **146**. Further, the groove **162** has a substantially square or rectangular cross-sectional shape as illustrated in FIGS. **4** and **5**.

Turning to FIG. **6**, the truss rod **150** is received and housed inside the groove **162**. The truss rod **150** may be press-fit into the groove **162** such that the groove **162** holds the truss rod **150** tightly. An optional strip of wood (not shown) may be positioned over the truss rod **150** to help maintain the truss rod **150** inside the groove **162** and help prevent the truss rod **150** from rotating inside the groove **162**. In some embodiment, the optional strip of wood (not shown) may be positioned inside the groove **162**. The fingerboard **140** is attached to the forward facing portion **160** and covers the groove **162** with the truss rod **150** positioned therein. The groove **162** has an opening **164** positioned at or near the peg head **148** that is accessible from outside the instrument **100** when the fingerboard **140** is attached to the forward facing portion **160** of the neck body **142**. A plurality of tuning peg assemblies **166** is mounted on the peg head **148**.

Returning to FIG. **1**, the body portion **120** includes a bridge assembly **170**. Each of the strings **130** extends between the bridge assembly **170** and one of the tuning peg assemblies **166**. Thus, the strings **130** extend between the peg head **148** and the body portion **120** of the instrument **100**.

As mentioned in the Background Section, the neck body **142** may be bent in any direction, including toward the strings **130** (referred to herein as "forward"), away from the strings (referred to herein as "backward"), sideways in a first direction (referred to herein as "right"), and/or sideways in a second direction (referred to herein as "left") opposite the first direction. The neck assembly **110** may also be bent in more than one direction and/or twisted. The terms "forward," "backward," "right," and "left" have been assigned arbitrarily for the purposes of describing the bending of the neck body **142** of the instrument **100**. These terms are not intended to be limiting. In FIGS. **1**, **6**, **10**, and **12-15**, an arrow "F" identifies the forward direction, an arrow "B" identifies the backward direction, an arrow "L" identifies the left direction, and an arrow "R" identifies the right direction.

Referring to FIG. **1**, the truss rod **150** is configured to bend in the forward direction (identified by the arrow "F"), and in the backward direction (identified by the arrow "B"). The truss rod **150** is sufficiently rigid to prevent the neck body **142** from bending in either the left direction (identified by the arrow "L"), of the right direction (identified by the arrow "R").

FIG. **7** is an exploded perspective view of the truss rod **150**. The truss rod **150** includes an elongated body portion **180**, and an adjustment member **182**. The body portion **180** illustrated has a generally rectilinear outside shape. By way of a non-limiting example, the body portion **180** may be constructed using an aluminum alloy. Aluminum was selected because it is strong and lightweight. In the embodiment illustrated, the body portion **180** has been machined from a single piece of material (e.g., aluminum alloy). However, this is not a requirement. In alternate embodiments, such as the one illustrated in FIGS. **13-15** and described below, the body portion **180** may be constructed from multiple components assembled together.

Referring to FIG. **7**, the body portion **180** is elongated and extends along a longitudinal axis "L1." Returning to FIG. **6**, the length of the body portion **180** may vary based at least in part on the length of the neck body **142**. In addition, the length and thickness of the body portion **180** may be adjusted and/or portions of the body portion **180** stiffened at the manufacturing stage as required to create a particular movement or action at a desired location (e.g., at a particular one of the frets **152**) along the neck assembly **110**. Thus, the configuration of the body portion **180** may be used to determine or change the playability of the instrument **100** (e.g., guitar), and may be used to adjust the instrument **100** based at least in part on the type or style of music for which the instrument **100** is to be used. In contrast, as mentioned above, prior art double action truss rods can be adjusted only in an arc shape and bent only in the middle.

Turning to FIG. **7**, the body portion **180** of the truss rod **150** includes a first rod portion **190** that is substantially parallel to a second rod portion **192**. The first and second rod portions **190** and **192** may be elongated and/or rod shaped. The first rod portion **190** has a first end portion **200** opposite a second end portion **202**, and an intermediate portion **204** that extends between the first and second end portions **200** and **202**. The second rod portion **192** has a first end portion **210** opposite a second end portion **212**, and an intermediate portion **214** that extends between the first and second end portions **210** and **212**. The first and second rod portions **190** and **192** are fixedly coupled together at their first end portions **200** and **210**, respectively. The intermediate portion **204** of the first rod portion **190** extends from the first end portion **200** of the first rod portion **190** alongside the intermediate portion **214** of the second rod portion **192** but stops short of the second end portion **212** of the second rod portion **192**. Thus, the second end portion **202** of the first rod portion **190** is spaced apart longitudinally (along the longitudinal axis "L1") from the second end portion **212** of the second rod portion **192** to define a gap **218** therebetween. As will be discussed below, the size of the gap **218** can be adjusted to control the curvature of the first and second rod portions **190** and **192**.

The intermediate portions **204** and **214** are spaced apart laterally from one another to define a longitudinally extending gap **219** therebetween. Optionally, a filler or spacer (not shown) may be inserted into the gap **219**. However, this is not a requirement. The intermediate portions **204** and **214** each have a rectangular cross-sectional shape.

When the truss rod **150** is positioned inside the groove **162** (see FIG. **6**), the first end portions **200** and **210** of the first and second rod portions **190** and **192**, respectively, are positioned near or adjacent to the attachment portion **144** (see FIG. **6**) of the neck body **142** (see FIG. **6**). The second end portion **212** of the second rod portion **192** is adjacent the opening **164** (see FIG. **6**) of the groove **162**.

Turning to FIG. **8**, the second end portion **202** of the first rod portion **190** has a first base portion **220** that projects in the backward direction toward the second rod portion **192**. The first base portion **220** is positioned alongside but spaced apart from the intermediate portion **214** of the second rod portion **192**. The first base portion **220** is movable with respect to the second rod portion **192**. The second end portion **202** has a surface **222** facing toward the second end portion **212** of the second rod portion **192**. A first channel **224** is formed in the second end portion **202** of the first rod portion **190**. At least a portion of the first channel **224** may be formed in the first base portion **220**. The first channel **224** has an opening **226** formed in the surface **222**. First inside threads **228** are formed inside the first channel **224**.

The second end portion **212** of the second rod portion **192** has a second base portion **230** that projects in the forward direction. The second end portion **212** has a surface **232** that faces away from the second end portion **202** of the first rod portion **190**. The second end portion **212** has a surface **233** that is opposite the surface **232** and faces toward the surface **222**. A second channel **234** is formed in the second end portion **212** of the second rod portion **192**. At least a portion of the second channel **234** may be formed in the second base portion **230**. The second channel **234** extends between the surfaces **232** and **233**. The second channel **234** has a first opening **236** formed in the first surface **232** and a second opening **237** formed in the second surface **233**. Second inside threads **238** are formed inside the second channel **234**. The second channel **234** is aligned with the first channel **224** so that the adjustment member **182** may be received into both the first and second channels at the same time.

The adjustment member **182** includes a proximal portion **250**, an intermediate portion **252**, and a distal portion **254**. In the embodiment illustrated, the adjustment member **182** has been implemented as a dual pitch metal screw or bolt configured to provide sufficient adjustability and/or mechanical advantage.

The proximal portion **250** includes first outside threads **260** having a first thread pitch. The proximal portion **250** is configured to pass through the open-ended second channel **234** and be received inside the opening **226** of the first channel **224**. The first outside threads **260** are configured to thread into the first inside threads **228** of the first channel **224**.

The intermediate portion **252** includes second outside threads **270** having a second thread pitch. The intermediate portion **252** is configured to be received inside the first opening **236** formed in the first surface **232**. The second outside threads **270** are configured to thread into the second inside threads **238** of the second channel **234**. In the embodiment illustrated, the intermediate portion **252** has a sufficiently large minimum outside dimension (e.g., diameter) to prevent the intermediate portion **252** from entering the opening **226** of the first channel **224**.

In some embodiments, such as embodiments in which the adjustment member **182** is implemented as a dual pitch screw or bolt, the first thread pitch is different from the second thread pitch. In the embodiment illustrated, the first thread pitch is less than the second thread pitch. For example, the second thread pitch may be twice the first thread pitch. In the embodiment illustrated, the first outside threads **260** and the second outside threads **270** extend in the same direction (e.g., clockwise) along the proximal and intermediate portions **250** and **252**, respectively. However, this is not a requirement. In alternate embodiments, the first outside threads **260** and the second outside threads **270** extend in opposite directions along the proximal and intermediate portions **250** and **252**, respectively.

The distal portion **254** has a keyway **290** formed therein. The distal portion **254** may be implemented as a conventional screw head or bolt head. Turning to FIG. **9**, the keyway **290** is configured to receive a key portion **292** of a tool **294** (e.g., a hexagonal screwdriver or bit). In alternate embodiments, the distal portion **254** may include a key portion (not shown) configured to be received by a keyway portion (not shown) of a tool (not shown). Thus, the distal portion **254** includes a first connector (e.g., the keyway **290**) configured to engage or mate with a second connector (e.g., the key portion **292**) of the tool **294**. When the first and second connectors are engaged, the tool **294** and the adjustment member **182** may be rotated together as a unit.

When the adjustment member **182** rotates in a first rotational direction (e.g., clockwise) depicted by an arrow "CW," the adjustment member **182** threads further into the first and second channels **224** and **234** (see FIG. **8**). However, as may be viewed in FIG. **8**, because the first thread pitch is less than the second thread pitch, the intermediate portion **252** longitudinally traverses the second channel **234** a greater distance than the proximal portion **250** longitudinally traverses the first channel **224**. Thus, referring to FIGS. **9** and **10**, the adjustment member **182** pushes on the second end portion **202** of the first rod portion **190** and widens the gap **218**. This may cause the truss rod **150** to curve toward the forward direction (indicated by the arrow "F") and/or away from the backward direction (indicated by the arrow "B"). In other words, when viewed from the front, the truss rod **150** may curve convexly.

On the other hand, when the adjustment member **182** rotates in a second rotational direction (e.g., counter clockwise) depicted by an arrow "CC," the adjustment member **182** threads outwardly from the first and second channels **224** and **234** (see FIG. **8**) toward the peg head **148** (see FIGS. **1** and **6**). Because the first thread pitch is less than the second thread pitch, the intermediate portion **252** longitudinally traverses the second channel **234** (see FIG. **8**) a greater distance than the proximal portion **250** (see FIG. **8**) longitudinally traverses the first channel **224** (see FIG. **8**) as shown in FIGS. **11** and **12**. Thus, the adjustment member **182** pulls the second end portion **202** of the first rod portion **190** toward the second end portion **212** of the second rod portion **192** and narrows the gap **218**. This may cause the truss rod **150** to curve away from the forward direction (indicated by the arrow "F") and/or toward the backward direction (indicated by the arrow "B"). In other words, when viewed from the front, the truss rod **150** may curve concavely.

As the adjustment member **182** is rotated in the first or second rotational directions (identified by arrows "CW" and "CC," respectively), the shape of the body portion **180** changes. For example, if the body portion **180** is curved toward the forward direction (indicated by the arrow "F") as illustrated in FIG. **10**, the adjustment member **182** may be rotated the second rotational direction (indicated by the arrow "CC") to change the curvature of the body portion **180**. If the adjustment member **182** is rotated sufficiently in the second rotational direction (indicated by the arrow "CC"), the body portion **180** may curve toward the backward direction (indicated by the arrow "B") as illustrated in FIG. **12**. Similarly, if the body portion **180** curves toward the backward direction (indicated by the arrow "B") as illustrated in FIG. **12**, the adjustment member **182** may be rotated the first rotational direction (indicated by the arrow "CW") to change the curvature of the body portion **180**. If the adjustment member **182** is rotated sufficiently in the first rotational direction (indicated by the arrow "CW"), the body portion **180** may curve toward the forward direction (indicated by the arrow "F") as illustrated in FIG. **10**.

The body portion **180** is depicted in FIGS. **9** and **10** having a maximum amount of forward curvature because the adjustment member **182** is fully threaded into the first and second channels **224** and **234** such that the distal portion **254** of the adjustment member **182** abuts the second end portion **212** of the second rod portion **192**. On the other hand, the body portion **180** is depicted in FIGS. **11** and **12** having a maximum amount of backward curvature because the second end portion **202** of the first rod portion **190** abuts (otherwise cannot travel any closer to) the second end portion **212** of the second rod portion **192**. The adjustment member **182** may be rotated in the first or second rotational directions (identified by arrows "CW" and "CC," respectively), to obtain curvatures between the maximum amounts of backward and forward curvatures.

Turning again to FIG. **6**, as mentioned above, the truss rod **150** is installed in the groove **162** of the neck body **142**. The fingerboard **140** is positioned over the groove **162** with the truss rod **150** therein and adhered to the forward facing portion **160** of the neck body **142**. Thus, the truss rod **150** is sealed inside the groove **162** and when so positioned, the body portion **180** is non-rotatable with respect to the neck body **142**.

The keyway **290** of the adjustment member **182** is positioned in the opening **164** to be accessible outside the neck body **142**. The key portion **292** (see FIGS. **9** and **11**) of the tool **294** may be inserted into the keyway **290** of the adjustment member **182** via the opening **164**. As explained above, by rotating the tool **294**, the adjustment member **182** may be rotated with respect to the body portion **180**.

Because the body portion **180** is non-rotatable with respect to the neck body **142**, when the adjustment member **182** is rotated with respect to the body portion **180**, the body portion **180** of the truss rod **150** tries to curve as illustrated in FIGS. **10** and **12**. As the body portion **180** tries to curve, the body portion **180** exerts forces on the neck body **142** and/or the fingerboard **140**. The forces exerted by the body portion **180** on the neck body **142** and/or the fingerboard **140** may change the shape of the neck body **142** and/or the fingerboard **140**. Thus, if the neck body **142** and the fingerboard **140** are curved forwardly (e.g., have a convex curvature when viewed from the front), the user may straighten or achieve a desired amount of curvature by rotating the adjustment member **182** in the second rotational direction (indicated by the arrow "CC" in FIG. **10**), which will cause the body portion **180** to curve toward the backward direction (indicated by the arrow "B") and exert backwardly directed forces on the neck body **142** and/or the fingerboard **140**. Conversely, if the neck body **142** and the fingerboard **140** are curved backwardly (e.g., have a concave curvature when viewed from the front), the user may straighten or achieve a desired amount of curvature by rotating the adjustment member **182** in the first rotational direction (indicated by the arrow "CW" illustrated in FIG. **12**), which will cause the body portion **180** to curve toward the forward direction (indicated by the arrow "F") and exert forwardly directed forces on the neck body **142** and/or the fingerboard **140**.

Thus, the adjustment member **182** may be characterized as exerting a longitudinally directed force (substantially parallel to the longitudinal axis "L1") on the second end portion **202** of the first rod portion **190**. The longitudinally directed force causes the first rod portion **190** to exert a first laterally directed force (in the forward or backward directions) on the first end portion **210** of the second rod portion **192**. The first laterally directed force causes the second rod portion **192** (and the first rod portion **190**) to exert a second laterally directed force (in the forward or backward directions) on the neck body **142** and/or the fingerboard **140**. The second laterally directed force may change the curvature of the neck body **142** and/or the fingerboard **140**.

The body portion **180** is substantially straight with respect to the right and left directions (identified by the arrows "R" and "L," respectively). Because the body portion **180** is non-rotatable inside the groove **162**, the body portion **180** maintains the straightness of the neck body **142** with respect to the right and left directions (identified by the arrows "R" and "L," respectively). Thus, unlike prior art truss rods that may rotate inside the neck of an instrument, the truss rod **150** prevents the neck body **142** from curving in the right and left directions while allowing the neck body **142** to bend in the forward and backward directions, as required. This allows the neck body **142** to be adjusted and/or tuned and preserves the playability of the instrument **100**.

Alternate Embodiment

FIGS. **13-15** depict a truss rod **300** that is an alternate embodiment of the truss rod **150** depicted in FIGS. **1** and **6-12**. Like reference numerals have been used to identify like components in FIGS. **1** and **6-15**. The truss rod **300** may replace the truss rod **150** (see FIG. **1**) in the instrument **100** (see FIG. **1**). Like the truss rod **150**, the truss rod **300** is configured to bend in the forward direction (identified by the arrow "F"), and in the backward direction (identified by the arrow "B"). The truss rod **300** is sufficiently rigid to prevent the neck assembly **110** (see FIG. **1**) from bending in either the left direction (identified by the arrow "L"), of the right direction (identified by the arrow "R").

Turning to FIG. **13**, the truss rod **300** includes the adjustment member **182** and an elongated body assembly **310**. When assembled, the body assembly **310** provides substantially identical functionality to that provided by the body portion **180** (see FIGS. **1** and **6-12**) of the truss rod **150**. However, instead of being formed from a single piece of material (e.g., aluminum alloy), the body assembly **310** includes a first rod **312** and a separate second rod **314**.

The elongated body assembly **310** extends along a longitudinal axis "L2." The body assembly **310** illustrated has a generally rectilinear outside shape. The first rod **312** extends alongside and is substantially parallel to the second rod **314**. In the embodiment illustrated, the first and second rods **312** and **314** each have a substantially rectangular cross-sectional shape. By way of a non-limiting example, the first and second rods **312** and **314** may each be constructed using an aluminum alloy.

Like the body portion **180** (see FIGS. **6-12**) of the truss rod **150**, the length of the body assembly **310** may vary based at least in part on the length of the neck body **142** (see FIGS. **1-6**). In addition, the length and thickness of the first rod **312** and/or the second rod **314** may be adjusted and/or portions of the first rod **312** and/or the second rod **314** may be stiffened at the manufacturing stage as required to create a particular movement or action at a desired location (e.g., at a particular one of the frets **152** illustrated in FIGS. **1** and **6**) along the neck assembly **110** (see FIGS. **1** and **6**). Thus, the configuration of the body assembly **310** may be used to determine or change the playability of the instrument **100** (e.g., guitar), and may be used to adjust the instrument **100** based at least in part on the type or style of music for which the instrument **100** is to be used.

The first rod **312** has a first end portion **320** opposite a second end portion **322**, and an intermediate portion **324** that extends between the first and second end portions **320** and **322**. The second rod **314** has a first end portion **330** opposite a second end portion **332**, and an intermediate portion **334** that extends between the first and second end portions **330** and **332**. The first and second rods **312** and **314** are connected together at their first end portions **320** and **330**, respectively. In the embodiment illustrated, the first end portions **320** and **330** are coupled together by one or more fasteners **336**. However, this is not requirement. In alternate embodiments, the first end portions **320** and **330** may be connected together using alternate means. For example, the first end portions **320** and **330** may be adhered or welded together. Referring to FIG. **14**, optionally, the first end portions **320** and **330** may each include one or more through-holes **338** configured to receive the one or more fasteners **336**.

Returning to FIG. **13**, the intermediate portion **324** of the first rod **312** extends from the first end portion **320** of the first rod **312** alongside the intermediate portion **334** of the second rod **314** but stops short of the second end portion **332** of the second rod **314**. Thus, the second end portion **322** of the first rod **312** is spaced apart longitudinally (along the longitudinal axis "L2") from the second end portion **332** of the second rod **314** to define a gap **340** therebetween.

The intermediate portions **324** and **334** of the first and second rods **312** and **314**, respectively, are positioned immediately alongside one another. When the adjustment member **182** is rotated with respect to the body assembly **310**, at least one of the intermediate portions **324** and **334** slides along the other.

Turning to FIG. **15**, the second end portion **322** has a surface **342** facing toward the second end portion **332** of the second rod **314**. A first channel **344** is formed in the second end portion **322** of the first rod **312**. The first channel **344** has an opening **346** formed in the surface **342**. First inside threads **348** are formed inside the first channel **344**.

The second end portion **332** of the second rod **314** has a base portion **350** that projects in the forward direction. The second end portion **332** has a surface **352** that faces away from the second end portion **322** of the first rod **312**. The second end portion **332** has a surface **353** that is opposite the surface **352** and faces toward the surface **342**. A second channel **354** is formed in the second end portion **332** of the second rod **314**. At least a portion of the second channel **354** may be formed in the base portion **350**. The second channel **354** extends between the surfaces **352** and **353**. The second channel **354** has a first opening **356** formed in the first surface **352** and a second opening **357** formed in the second surface **353**. Second inside threads **358** are formed inside the second channel **354**. The second channel **354** is aligned with the first channel **344** so that the adjustment member **182** may be received into both the first and second channels at the same time. In the embodiment illustrated, the second channel **354** extends partially into the intermediate portion **334** forming a groove **360** therein. However, this is not a requirement.

The second channel **354** is configured to allow the proximal portion **250** to pass therethrough to be received inside the opening **346** of the first channel **344**. The first outside threads **260** are configured to thread into the first inside threads **348** of the first channel **344**. The intermediate portion **252** is configured to be received inside the first opening **356** formed in the first surface **352**. The second outside threads **270** are configured to thread into the second inside threads **358** of the second channel **354**. In the embodiment illustrated, the intermediate portion **252** has a sufficiently large minimum outside dimension (e.g., diameter) to prevent the intermediate portion **252** from entering the opening **346** of the first channel **344**.

When the adjustment member **182** rotates in the first rotational direction (e.g., clockwise) depicted by an arrow "CW," the adjustment member **182** threads further into the first and second channels **344** and **354**, pushing the second end portion **322** of the first rod **312** and widening the gap **340** (see FIG. **13**). This may cause the truss rod **300** to curve toward the forward direction (indicated by the arrow "F") and/or away from the backward direction (indicated by the arrow "B"). In other words, when viewed from the front, the truss rod **300** may curve convexly.

On the other hand, when the adjustment member **182** rotates in the second rotational direction (e.g., counter clockwise) depicted by an arrow "CC," the adjustment member **182** threads outwardly from the first and second channels **344** and **354** toward the peg head **148** (see FIGS. **1-3** and **6**), pulling the second end portion **322** of the first rod **312** toward the second end portion **332** of the second rod **314** and narrowing the gap **340** (see FIG. **13**). This may cause the truss rod **300** to curve away from the forward direction (indicated by the arrow "F") and/or toward the backward direction (indicated by the arrow "B"). In other words, when viewed from the front, the truss rod **300** may curve concavely.

Thus, as the adjustment member **182** is rotated in the first or second rotational directions (identified by arrows "CW" and "CC," respectively), the shape of the body assembly **310** changes. Because the body assembly **310** is non-rotatable with respect to the neck body **142** (see FIGS. **1** and **6**), when the adjustment member **182** is rotated with respect to the body assembly **310**, the body assembly **310** of the truss rod **300** tries to curve. As the body assembly **310** tries to curve inside the groove **162** (see FIGS. **1** and **6**), the body assembly **310** exerts forces on the neck body **142** and/or the fingerboard **140** (see FIGS. **1** and **6**). The forces exerted by the body assembly **310** on the neck body **142** and/or the fingerboard **140** change the shape of the neck body **142**. Further, because the body portion **180** is non-rotatable inside the groove **162**, the body portion **180** maintains the straightness of the neck body **142** with respect to the right and left directions (identified by the arrows "R" and "L," respectively). Thus, the truss rod **300** prevents the neck body **142** from curving in the right and left directions while allowing the neck body **142** to bend in the forward and backward directions, as required. This allows the neck body **142** to be adjusted and/or tuned and preserves the playability of the instrument **100**.

In embodiments in which the adjustment member **182** is implemented using a dual pitch screw or bolt, the truss rod **150** and/or the truss rod **300** may not be as thick or as heavy as prior art truss rods configured to produce the same amount of torque. This makes instruments (e.g., the instrument **100**) that incorporate either the truss rod **150** or the truss rod **300** desirable because such instruments may be more playable than heavier instruments that incorporate prior art double action truss rods.

The foregoing described embodiments depict different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely exemplary, and that in fact many other architectures can be implemented which achieve the same functionality. In a conceptual sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected," or "operably coupled," to each other to achieve the desired functionality.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the appended claims. It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means at least two recitations, or two or more recitations).

Accordingly, the invention is not limited except as by the appended claims.

The invention claimed is:

1. A truss rod comprising:

a bendable body portion having a first elongated portion positioned alongside a second elongated portion, the first elongated portion having a first end portion opposite a second end portion, the second elongated portion having a first end portion opposite a second end portion, the first end portions of the first and second elongated portions being coupled together, the second end portion of the first elongated portion being movable with respect to the second end portion of the second elongated portion, the second end portion of the first elongated portion having a threaded channel with inside threads; and

a rotatable adjustment member having outside threads threadedly engaging the inside threads of the threaded channel, rotation of the adjustment member in a first rotation direction reducing a distance between the second end portion of the first elongated portion and the second end portion of the second elongated portion thereby bending the body portion, and rotation of the adjustment member in a second rotation direction opposite the first rotation direction increasing the distance between the second end portion of the first elongated portion and the second end portion of the second elongated portion thereby bending the body portion.

2. The truss rod of claim **1**, wherein rotating the adjustment member in the first rotation direction bends the body portion in a first bend direction, and rotating the adjustment member in the second rotation direction bends the body portion in a second bend direction, the first bend direction being opposite the second bend direction.

3. The truss rod of claim **2**, wherein the first and second elongated portions are configured to resist bending in directions orthogonal to the first and second bend directions.

4. The truss rod of claim **1**, wherein the rotatable adjustment member is a dual pitch screw.

5. The truss rod of claim **1**, wherein the threaded channel is a first threaded channel, the inside threads are first inside threads, and the outside threads are first outside threads,

the second end portion of the second elongated portion has a second threaded channel with second inside threads,

the adjustment member has second outside threads threadedly engaging the second inside threads of the second threaded channel,

the first outside threads have a first thread pitch,

the second outside threads have a second thread pitch, and the first thread pitch is less than the second thread pitch.

6. The truss rod of claim **5**, wherein the second thread pitch is twice the first thread pitch.

7. The truss rod of claim **1**, wherein the first elongated portion is shorter than the second elongated portion.

8. The truss rod of claim **1**, wherein the body portion is constructed from an aluminum alloy.

9. The truss rod of claim **1** for use with a groove formed in a neck body of a musical instrument, wherein the truss rod is configured to be received inside the groove and when so received, to be non-rotatable inside the groove when the adjustment member is rotated.

10. The truss rod of claim **1**, wherein the body portion has a rectilinear shape.

11. A truss rod for use with a neck body of a musical instrument, the neck body having curvature, the truss rod comprising:

a first rod portion having a threaded channel with inside threads;

a second rod portion connected to the first rod portion; and

an adjustment member having outside threads threadedly engaging the inside threads of the first rod portion, the adjustment member being rotatable inside the threaded channel, and when so rotated, causing the first and second rod portions to bend and exert sufficient laterally directed force on the neck body to change the curvature of the neck body.

12. The truss rod of claim **11**, wherein the first rod portion is shorter than the second rod portion.

13. The truss rod of claim **11**, wherein

the threaded channel is a first threaded channel, the inside threads are first inside threads, and the outside threads are first outside threads,

the second rod portion had a second threaded channel with second inside threads,

the adjustment member has second outside threads threadedly engaging the second inside threads of the second rod portion,

the first outside threads have a first thread pitch,

the second outside threads have a second thread pitch, and

the first thread pitch is different from the second thread pitch.

14. A musical instrument comprising:

a body portion;

a neck assembly coupled to the body portion, the neck assembly comprising a neck body housing a truss rod, the neck body having a curvature, the truss rod including:

(a) a first rod portion having a threaded channel with inside threads,

(b) a second rod portion connected to the second rod portion, and

(c) an adjustment member having outside threads threadedly engaging the inside threads of the first rod portion, the adjustment member being rotatable inside the threaded channel, and when so rotated, causing the first and second rod portions to bend and exert sufficient laterally directed force on the neck body to change the curvature of the neck body; and one or more strings, each having a first end and a second end, the first end being attached to the body portion and the second end being attached to the neck assembly.

15. The musical instrument of claim **14**, wherein

the threaded channel is a first threaded channel, the inside threads are first inside threads, and the outside threads are first outside threads,

the second rod portion had a second threaded channel with second inside threads,

the adjustment member has second outside threads threadedly engaging the second inside threads of the second rod portion,

the first outside threads have a first thread pitch,

the second outside threads have a second thread pitch, and

the first thread pitch is different from the second thread pitch.

16. The musical instrument of claim **14**, wherein the first and second rod portions are connected together by one or more laterally extending fasteners.

17. The musical instrument of claim **14**, wherein the first and second rod portions are formed as a unit from a single piece of material.

18. The musical instrument of claim **14**, wherein the first rod portion is shorter than the second rod portion.

19. The musical instrument of claim **14**, wherein the first and second rod portions are constructed from an aluminum alloy.

20. The musical instrument of claim **14**, wherein the neck body comprises a groove,

the truss rod is housed inside the groove, and

the truss rod is non-rotatable with respect to the groove.

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